Washington State Department of Transportation

Imazapic

Roadside Vegetation Management Herbicide Fact Sheet

This fact sheet was developed by Oregon State University and Intertox, Inc. to assist interested parties in understanding the risks associated with pesticide use in Washington State Department of Transportation's (WSDOT) Integrated Vegetation Management program.

Introduction

Imazapic is an imidazolinone herbicide used to control selected annual and perennial grasses and broadleaf weeds. Imazapic kills plants by inhibiting the production of branched chain amino acids, which are necessary for protein synthesis and cell growth. Imazapic is the only active ingredient in the herbicide product **Plateau** (23.6%). According to the product label, **Plateau** also contains 76.4% inert ingredients (unspecified). The Washington State Department of Transportation (WSDOT) uses **Plateau** for pre-emergent control of weeds and some grasses. **Plateau** also has uses on pastures and rangeland.

WSDOT assessed the potential risks to human, wildlife, and aquatic animals exposed to imazapic in their Integrated Vegetation Management (IVM) program. Evaluating potential risks takes into account both the toxicity of a pesticide and the characteristics of possible exposure.

Laboratory Testing: Before pesticides are registered by the U.S. Environmental Protection Agency (EPA), they must undergo laboratory testing for short-term (acute) and long-term (chronic) health effects. Laboratory animals are purposely fed doses high enough to cause toxic effects. These tests help scientists determine how chemicals might affect humans, domestic animals, or wildlife in cases of overexposure. Pesticide products used according to label directions are unlikely to cause toxic effects. The amount of pesticide that people and pets may be exposed to is low compared to the doses fed to laboratory animals.

WSDOT Application Rates and Use Patterns on Highway Rights-of-Way

Plateau is applied at a maximum of 12 fluid ounces per acre per year, which is equivalent to 0.19 pounds of the active ingredient imazapic per acre per year. WSDOT's typical application rate of **Plateau** is equivalent to about 0.093 pounds of imazapic per acre per year. Applicators use truck mounted booms to make a single application of imazapic in the spring or early summer. WSDOT only anticipates using imazapic in limited areas and only in Eastern Washington.

Human Health Effects

The U.S. Environmental Protection Agency (U.S. EPA) classifies **Plateau** as category IV (Low Toxicity) with a signal word of CAUTION (see "Toxicity Category and Signal Word" table).

Acute toxicity: Imazapic has very low toxicity if individuals accidentally eat, touch, or inhale residues. Imazapic did not result in skin sensitization when tested on guinea pigs or skin or eye irritation when tested on rabbits.

Chronic toxicity: Imazapic does not appear to be toxic to experimental rodents at relatively high concentrations in the diet. Dogs, however, appear to be more sensitive than rodents, and

LD50/LC50: Acute toxicity is commonly measured by the lethal dose (LD) or lethal concentration (LC) that causes death in 50 percent of treated laboratory animals. LD50 indicates the dose of a chemical per unit body weight of an animal and is expressed as milligrams per kilogram (mg/kg). LC50 is the concentration of a chemical per volume of air or water and is expressed as milligrams per liter (mg/L). Chemicals are highly toxic when the LD50 or LC50 value is small and practically nontoxic when the value is large. However, the LD50 and LC50 do not reflect potential health effects such as cancer, birth defects, or reproductive toxicity that may occur at levels of exposure below those that cause death.

the major signs of toxicity include adverse effects on the muscle, blood, and liver.

Reproductive effects: In several standard tests required for pesticide registration, imazapic has failed to show any indication of adverse effects on reproduction or development.

Carcinogenic effects: In 2-year feeding studies in rats and mice, no evidence of carcinogenicity was found. Imazapic was also negative in four assays for mutagenicity. Imazapic is classified by U.S. EPA as "not likely" to be carcinogenic in humans.

Fate in humans and animals: The metabolism and kinetics of imazapic have been studied in rats, hens, and goats. These studies suggest that imazapic is rapidly excreted in the urine, principally as the parent compound (*i.e.*, imazapic). Imazapic does not accumulate (build up) in tissues.

Toxicity Category and Signal Word

	High Toxicity (*Danger*)	**Moderate Toxicity (*Warning*)**	**Low Toxicity (*Caution*)**	**Very Low Toxicity (*Caution*)**
Oral LD50	Less than 50 mg/kg	50-500 mg/kg	500-5000 mg/kg	Greater than 5000 mg/kg
Dermal LD50	Less than 200 mg/kg	200-2000 mg/kg	2000-5000 mg/kg	Greater than 5000 mg/kg
Inhalation LC50	Less than 0.05 mg/l	0.05-0.5 mg/l	0.5-2.0 mg/l	Greater than 2.0 mg/l
Eye Effects	Corrosive	Irritation persisting for 7 days	Irritation reversible in 7 days	Minimal effects, gone in 24 hrs
Skin Effects	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation

Note: Highlighted categories specify the range for aminopyralid use cited in this fact sheet.

Wildlife and Aquatic Effects

Effects on mammals: Imazapic is practically non-toxic to mammals based on an acute oral LD50 > 5,000 mg/kg in rats, an acute dermal LD50 > 5,000 mg/kg in rabbits, and acute inhalation LC50 values of 2.38 mg/L and 9.52 mg/L for 4 and 1 hours, respectively, in the rat.

Effects on birds: Imazapic is practically non-toxic to birds based on acute LC50s >5000 mg/kg for mallard duck and bobwhite quail following acute dietary exposures.

Effects on fish: Imazapic is practically non-toxic to fish based on acute toxicity tests. Acute 96-hour LC50 values for channel catfish, sunfish, trout, and sheepshead minnow were all >100 mg/L.

Effects on aquatic insects: Imazapic is practically non-toxic to aquatic invertebrates based on acute toxicity tests. The LC50 for water fleas (*Daphnia magna*) is > 100 mg/L.

Wildlife Toxicity Category

Risk Category	**Mammals**	**Birds**	**Fish or Aquatic Insects**
	Acute Oral or Dermal LD_{50} (mg/kg)	**Acute Oral LD_{50} (mg/kg)**	**Acute LC_{50} (mg/L)**
Practically nontoxic	>2,000	>2,000	>100
Slightly toxic	501-2,000	501-2,000	>10-100
Moderately toxic	51-500	51-500	>1-10
Highly toxic	10-50	10-50	0.1-1
Very highly toxic	<10	<10	<0.1

Note: Highlighted categories specify the range for imazapic use cited in this fact sheet.

Environmental Fate

The half-life of imazapic in soils ranges from 31 to 410 days, with a typical time of 120 days (see "Half-life" text box). Microbes and sunlight break it down. Imazapic shows moderate to high mobility in the environment, with a

moderate potential to leach through soils and contaminate groundwater. With sufficient rainfall, alkaline soils low in clay and organic matter are particularly susceptible to imazapic leaching. It does not bioconcentrate (build up) through the food chain. Imazapic is adsorbed through the leaves and the roots where it is transported to other parts of the plant.

Half-life is the time required for half of the compound to degrade.

1 half-life = 50% degraded
2 half-lives = 75% degraded
3 half-lives = 88% degraded
4 half-lives = 94% degraded
5 half-lives = 97% degraded

Remember: the amount of a chemical remaining after a half-life will always depend on the amount of the chemical originally applied.

Human Health Risk Assessment

WSDOT evaluated several human exposure scenarios, including workers applying herbicides and the public (adults and children) picking and eating drift-contaminated berries, eating drift-contaminated garden vegetables, and walking through sprayed vegetation. For each exposure scenario, WSDOT evaluated conditions of average exposure and extremely conservative conditions of maximum exposure (see "Human Cancer/Non-cancer Risk Classification" text box and "Human Risk Classification for Average Exposure Scenarios" table).

Human Cancer/Non-cancer Risk Classification: Scientists estimate non-cancer health risks by generating a hazard quotient (HQ). This number is the exposure divided by the toxicity. When the HQ is less than 1, exposures are unlikely to cause any adverse health effects. When the HQ is greater than 1, the potential for non-cancer health effects should be considered. Risk assessments for chemicals that cause cancer (carcinogens) estimate the probability of an individual developing cancer over a lifetime. Cancer risks estimated in this way are very conservative, and actual cancer risks are likely to be much lower. Cancer risk estimates of less than 1 in 100,000 are within the range considered negligible by most regulatory agencies.

Imazapic is expected to pose negligible potential risks of adverse non-cancer effects to WSDOT workers and the public under conditions of average and maximum exposure. All hazard quotients are below 1. Imazapic is not regulated as a carcinogen.

Wildlife Risk Assessment

Wildlife risk assessment considers herbicide behavior in the environment and routes of exposure. Indirect exposure to mammals and birds can occur when they eat contaminated prey or vegetation. Direct exposure can occur when mammals and birds contact herbicide residues with their skin or eyes or when they inhale vapors or particulates. WSDOT's current application rates and use patterns for imazapic pose an insignificant risk to mammals and birds. The estimated dietary exposures to rats, mice, and meadow voles from maximum label application rates would be approximately 38,000, 4,500, and 5,900-fold lower, respectively, than the acute dietary LD50 for rats. The estimated dietary exposures to bobwhite quail, marsh wrens, and American robins from WSDOT's application practices would be approximately 24,000, 2,700, and 2,100-fold lower, respectively, than the acute dietary LD50 for bobwhite quail.

Human Risk Classifications for Average Exposure Scenarios

Hazard Quotient (Non-cancer Risk)	Cancer Risk	Potential Risks and Management Priority
Less than 1	Less than 1 in 100,000	**Negligible**
Between 1 and 10	Between 1 in 10,000 and 1 in 100,000	**Low**
Between 10 and 100	Between 4 in 1,000 and 1 in 10,000	**Moderate**
Greater than 100	Greater than 4 in 1,000	**High**

Note: Highlighted categories specify the range of potential risk for specific exposure scenarios involving imazapic.

Aquatic Risk Assessment

WSDOT takes extra precautions applying herbicides near open water, wetlands, and wellhead protection zones. However, contamination may result from application drift, rainfall runoff, or residue leaching through the soil into groundwater. Fish and aquatic insect exposure to imazapic occurs primarily through direct contact with contaminated surface waters. Due to its relatively low toxicity and low application rate, the estimated risks to fish and aquatic invertebrates from WSDOT's current use patterns for imazapic are estimated to be low in

all areas of the state.

Additional Resources

- National Pesticide Information Center 1-800-858-PEST (7378) and http://npic.orst.edu
- Washington State Department of Transportation, Roadside Maintenance Branch 1-360-705-7865
- Washington Department of Agriculture, Pesticide Management Division 1-877-301-4555 (toll free)